CHAPTER 4 – SYSTEM REQUIREMENTS AND DESIGN

4.1 OVERVIEW

The requirements analysis is an important phase of software development. Getting the right information to be specified in the requirements is crucial as inaccurate information may result in the creation of a software product, which does not satisfy the requirements.

Upon completion of requirements specification, system design commences. System design is a process of devising and documenting the overall architecture for a software system. It includes identifying the major components of the system, specifying what they are to accomplish, and establishing the interfaces among the components (Pressman, 2001). This chapter discusses the functional requirements, and the system design of MPID.

4.2 SYSTEM REQUIREMENTS

Requirements gathering process is regarded as one of the most important functions in building a software system. The sections below discuss the functional requirements and non-functional requirements of MPID.

4.2.1 Functional Requirements

Functional system requirements are system services, which are expected by the user of the system (Sommerville, 1998). In product development, it is useful to distinguish between the baseline functionality necessary for any system to compete in that product domain, and features that differentiate the system from other similar products. Use cases have become a widespread practice for capturing functional requirements. MPID is divided into four main

modules, namely, introduction module, S&T features module, current growth of mobile phone usage module and forecast module, as shown in Figure 4.1. Each module is described briefly below.

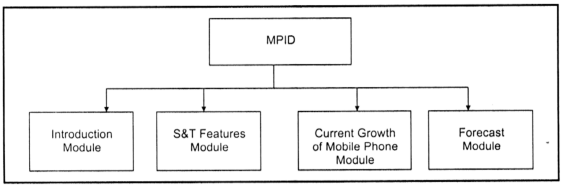

Figure 4.1: Main Modules of MPID

- Introduction Module

This module contains an animated introduction file that explains MPID to users.

- S&T Features Module

This module is designed to allow users to add, modify, delete and view the mobile phone features that are related to the advancement in S&T. This module allows users to add, modify, delete and view values of the purchasing preference of mobile phone subscribers. The features and purchasing preference are used in the forecast module. This module allows users to view the purchasing preference of mobile phone subscribers for a selected feature displayed according to year. The results are displayed in tabular and graphical formats.

- Current Growth of Mobile Phone Module

This module allows the users to view the current growth of mobile phone usage for the past years. This module displays the number of mobile phone subscribers and the growth rate of

mobile phone usage in a data grid and illustrates the data in a chart. This module allows the user to add and delete data on the current growth of mobile phone usage. Users can view and print out the results using Crystal report, a third party report generator.

- Forecast Module

The forecast module allows users to forecast the growth of mobile phone usage. The forecasted growth and growth rate of mobile phone usage using this module are based on the mobile phone features. Users are required to select the year of forecast. They are also required to select either one or two mobile phone features. This module generates a trend line formula based on the data input by the user. The forecasted results are displayed in a data grid. The trend of the forecasted growth and growth rate of mobile phone usage are displayed in a chart. Users can view and print out the results using Crystal report.

The requirements specification for each feature is described in Appendix C. The complete requirements specifications for the S&T feature module, growth of mobile phone module and forecast module are displayed in the requirements specification document.

4.2.2 Non-functional Requirements

Non-functional requirements set out the constraints under which the system must operate, and the standards, which must be met by the system (Sommerville, 1998). The non-functional requirements in the system include:

- Ease of use

Ease of use creates users' confidence when using MPID. They should be able to understand instructions easily.

- Usefulness

MPID can make forecast of mobile phone usage and indirectly helps in decision-making in telecommunication companies.

- User satisfaction

User satisfaction ensures that MPID responds quickly to inputs. The error messages within MPID have to be understandable. It should be possible to perform the task within MPID in a straightforward manner.

- Information display

To ensure that information on the screen is organised logically and the reports generated are clear. Information displayed on the screen should be adequate and the screen sequences are logical.

- Design

To ensure that the colour combination is suitable, wordings are clear and easy to read, the graphs are clear and easy to understand and navigation from one screen to another is easy.

- Performance

MPID should have a fast response time. The response time for report generation should also be fast, less than eight seconds.

4.3 SYSTEM ARCHITECTURE

Architecture design represents the structure of data and program components that are required to build a component based system (Pressman, 2001). MPID consists of four types of components. These include the user interface, program modules, database, and animation file. Figure 4.2 shows how the components communicate.

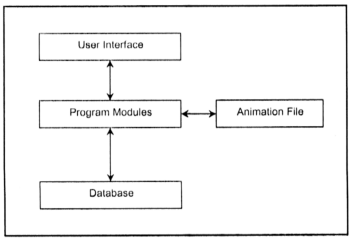

Figure 4.2: Communication between MPID Components

The user interface communicates with the program modules. The program modules communicate with the database and animation files directly. The following sections describe the MPID database design, program design, user interface design and animation design.

4.4 DATABASE DESIGN

Database systems provide file processing capabilities. They also organize data in a manner to facilitate queries. MPID uses data-aware controls and bound controls associated with Data Active Objects (DAO). There is only one database (dbase.mdb) in MPID. This database is used to store data of the mobile phone usage growth rate and mobile phone features data from the survey conducted.

The database consists of a few tables (Forecast, Factors and YearGrowth). It also contains tables that can be created and deleted during system runtime (Features). The data fields for these tables are shown in Tables 4.1 – 4.4.

Table 4.1: Factors Table

Field Name	Data Type	Field Size	Description
ID	Auto Number	Integer	Feature ID
Factor	Text	50	Mobile Phones Feature
Description	Memo	255	Descriptions of Feature

Table 4.2: Forecast Table

Field Name	Data Type	Field Size	Description
Year	Text	4	Forecast Year ID
Forecast	Number	Long Integer	Forecasted Mobile Phone Usage Growth Values

Table 4.3: YearGrowth Table

Field Name	Data Type	Field Size	Description
Year	Text	4	Growth Year ID
Growth	Number	Long Integer	Current Mobile Phone Usage Growth Values

Table 4.4: Features Table

Field Name	Data Type	Field Size	Description
Year	Text	4	Features Year ID
FeatureValue	Number	Long Integer	Total Mobile Phone Features Values
WGValue	Number	Long Integer	Mobile Phone Features Values Based on the Working Group
WGValue	Number	Long Integer	Mobile Phone Features Values Based on the University Students

4.5 PROGRAM DESIGN

The Unified Modelling Language (UML) was used in the construction of the program modules. UML is a modelling language for specifying, visualizing, constructing, and documenting the facts of a system-intensive process (Alhir, 1998). It is a type of graphical

language with sets of rules and semantics. The rules and semantics of the model are expressed in simple English, in a form known as object-constraint language (OCL) (Rational Software Corporation, 1997).

The primary goals in designing MPID using UML are as follows (Larman, 1998):

i. Provide user with a ready-to-use visual modelling language so that they can develop and exchange meaningful models.

ii. Provide extensibility and specialization mechanisms to extend the core concepts.

iii. Be independent of particular programming languages and development processes.

iv. Provide a formal basis for understanding the modelling language.

v. Encourage the growth of the Object-Oriented (OO) tool market.

vi. Support higher-level development concepts.

vii. Integrate best practices and methodologies.

The UML class diagram is the main static analysis diagram. A class diagram is a collection of static modelling elements such as classes and relationships (Rational Software Corporation, 1997). Figures 4.3 – 4.7 show the class diagrams for MPID. The forms and modules are briefly described in Chapter 5. Figure 4.3 displays the general relationship between the forms in MPID. There is one Multiple Document Interface (MDI) form (frmMain), five MDI child forms (frmforecast, frmIntroFlash, frmFactors, frmMobileGrowthRate and frmFactorValue) and three Single Document Interface (SDI) forms (frmSplash, frmAbout and frmData).

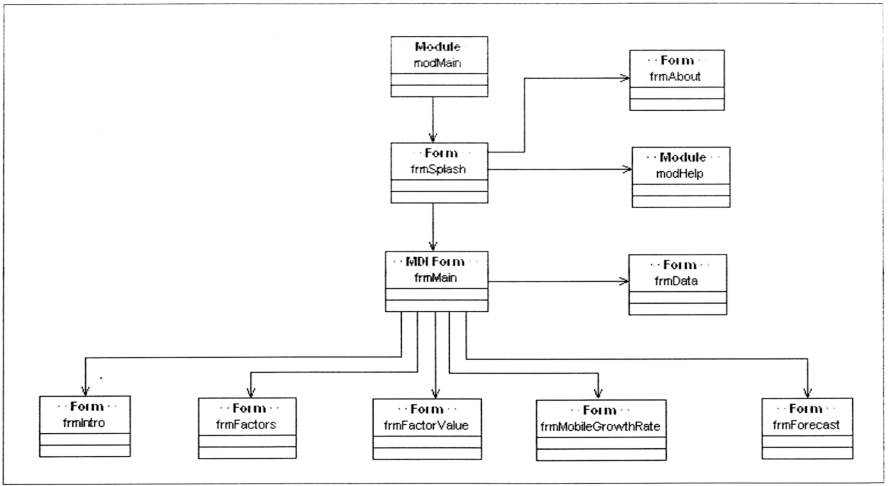

Figure 4.3: Overall Class Diagram

Figure 4.4 shows the class diagram for MPID introduction form (frmIntroFlash). There is one form (frmIntro) and one module (modCenterAlign) related to frmIntroFlash.

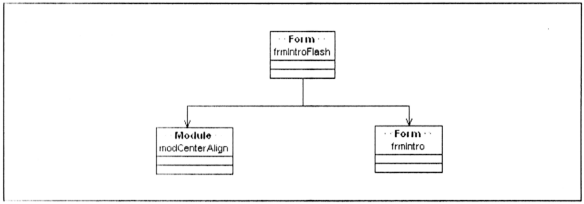

Figure 4.4: Class Diagram for MPID Introduction Form (frmIntroFlash)

Figure 4.5 shows the class diagram for description of feature form (frmFactor). There are seven forms (frmFactorValue, frmAddFactor, frmModifyFactor, frmDeleteFactor, frmAddFactorValue, frmModFactorValue and frmDeleteFactorValue) and two modules (modBassModule and modCenterAlign) related to frmFactor.

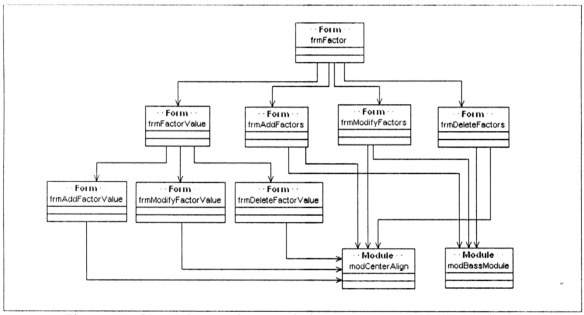

Figure 4.5: Class Diagram for Description of Features Form (frmFactor)

Figure 4.6 shows the class diagram for the growth of mobile phone usage form (frmMobileGrowthRate). There are four forms (frmAddGrowth, frmModifyGrowth,

frmDeleteGrowth and frmViewerGrowth), one code module (modCenterAlign), one class module (clsPrintDialog) and one Crystal report (MobilePhoneGrowth) related to frmMobileGrowthRate.

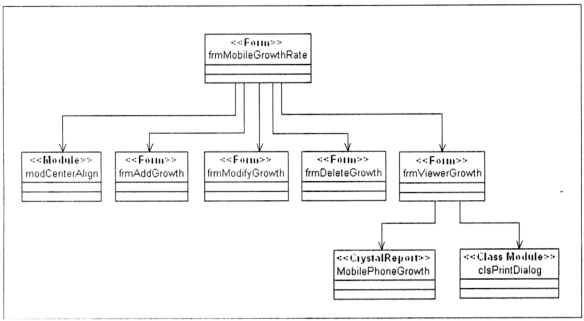

Figure 4.6: Class Diagram for Growth of Mobile Phone Form (frmMobileGrowthRate)

Figure 4.7 shows the class diagram for mobile phone forecast form (frmForecast). There are seven forms (frmViewerForecast, frmRegenerateForecast, frmRegenerateForecastChart, frmCompare, frmCompareForecast, frmRegenerateForecastComp and frmRegenerateForecastCompChart), six code modules (modCenterAlign, modFlexGrid, modReg, modEigen, modConjug and modCStatistics), one class module (clsPrintDialog) and one Crystal report (ForecastReport) related to frmForecast.

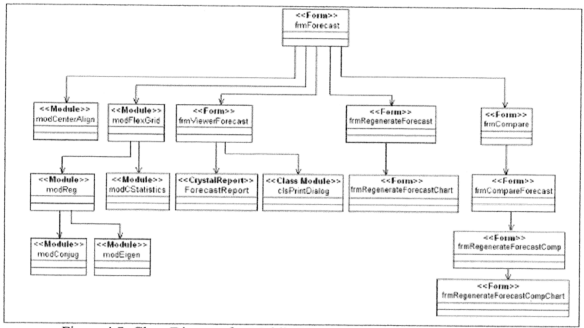

Figure 4.7: Class Diagram for Mobile Phone Forecast Form (frmForecast)

4.6 USER INTERFACE DESIGN

User interface design creates an effective communication medium between a human and computer (Pressman, 2001). The sections below discuss the navigation design and the screen design of MPID.

4.6.1 Navigation Design

There are several navigational structures that can be used, often in combination – linear, hierarchical, non-linear and composite (Dix et al, 1998). MPID uses a non-linear navigation structure. Different types of functions and contents can be accessed from any point in MPID. This is achieved through the use of a navigational toolbar. Figure 4.8 shows the four navigational icons in the toolbar of MPID.

Figure 4.8: Flexible Navigation Using Navigation Tab Strip

4.6.2 Screen Design

Screen design is an important aspect in the design phase. From a formal perspective, it is possible to produce interfaces that are functionally identical, but which have very different effects upon the users because of their appearance (Dix et al, 1998).

Figures 4.9 – 4.13 show the main designs of MPID. Figure 4.9 shows the design of the main MPID form.

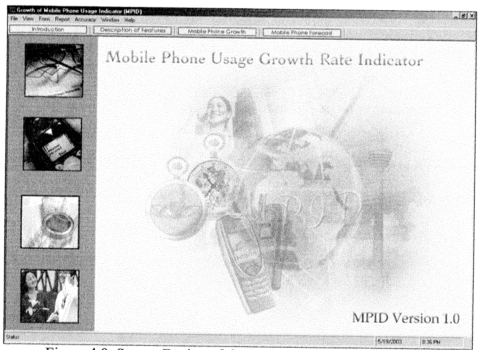

Figure 4.9: Screen Design of the Main MPID Form (frmMain)

Figure 4.10 shows the introduction form of MPID. The screen has a navigational button that links to the appropriate forms within the system. The screen is linked to the frmIntroFlash.

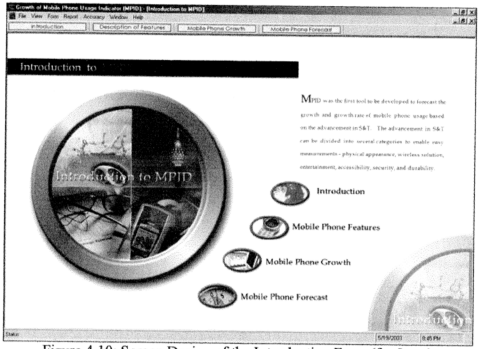

Figure 4.10: Screen Design of the Introduction Form (frmIntro)

Figure 4.11 shows the screen design of the feature form. The feature is selected using the drop down list. The radio buttons are used to select the graph type. The Add, Modify, Delete, View and Close are all command buttons.

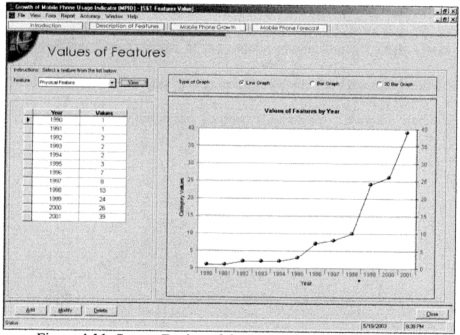

Figure 4.11: Screen Design of the Features Form (frmFactors)

Figure 4.12 shows the screen design of the growth of mobile phone usage form. The year value is selected using the drop down list. The tab strip is used to navigate among the mobile phone usage growth rate data grid, mobile phone usage growth and growth rate chart. The Add, Delete, Report, View and Close are all command buttons.

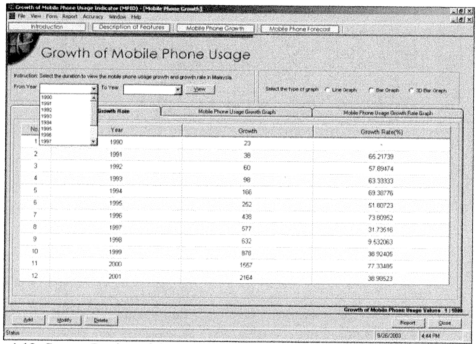

Figure 4.12: Screen Design of the Mobile Phone Growth Form (frmMobileGrowthRate)

Figure 4.13 shows the screen design of the mobile phone forecast form. Users can select data using drop down lists. The data grid is used to display the forecasted and actual growth of mobile phone usage. The Forecast, Report, Regenerate, Compare and Close are all command buttons.

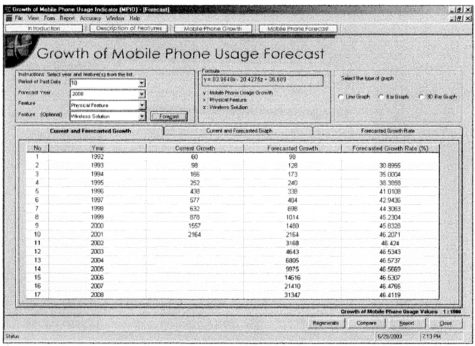

Figure 4.13: Screen Design of the Mobile Phone Forecast Form (frmForecast)

4.6.3 Report Design

Reports should be well designed and organized to optimize the information delivers to its readers. Figures 4.14 – 4.15 show the reports screens in MPID. Figure 4.14 shows the design of the Growth of Mobile Phone Usage report. The report shows the tabulated and graphical chart produced for the number of subscribers and the growth rate of mobile phone usage in Malaysia.

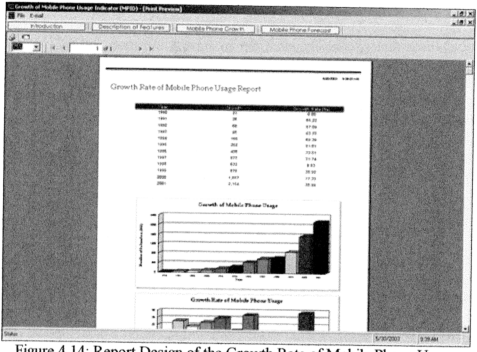

Figure 4.14: Report Design of the Growth Rate of Mobile Phone Usage

Figure 4.15 shows the design of the Mobile Phone Usage Forecast Report. The report shows the tabulated and graphical chart produced for the forecasted number of subscribers and the forecasted growth rate of mobile phone usage in Malaysia.

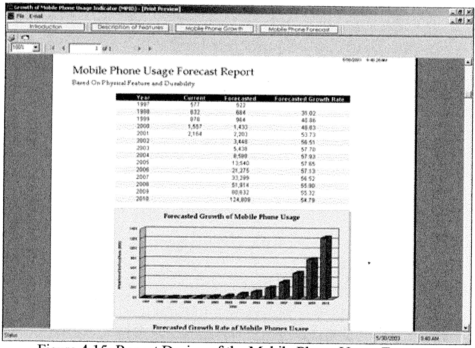

Figure 4.15: Report Design of the Mobile Phone Usage Forecast

4.7 ANIMATION DESIGN

Animation illustrates the dynamic aspects of the intended user-system interaction, which may not be possible with traditional paper-based storyboards (Dix et al, 1998). In designing the animation content of MPID, the design is organised screen-by-screen to present a well-composed storyboard. Animation is used to develop the introduction form.

4.8 SUMMARY

This chapter discusses the system requirements and design of the MPID system. The design phase focuses on the aspects of database, program modules, user interface and animation. For database design, details on the tables and field structures are described. The designs of program modules are used to show the relationship between forms and modules in MPID. Samples of screen designs are also included to illustrate the user interface and animation design.